The present invention discloses the application of acoustic pressure waves and resulting vibrational energy to atomize excess moisture and entrapped moisture in hard to reach cracks and crevices, thus overcoming the surface tensional forces and allowing increased efficiency of the hot air dryers and the infrared heaters. The acoustic pressure waves, generated by a transducer and transferred to the module through the air, will impinge the module at the angle prescribed and not be substantially affected by the volume or velocity of the hot air flow caused by the hot air dryers.

The present inventions further discloses the application of vibrational energy through close proximity to dry preferably planar tooling such as stencils where heat is not desirable.

The present invention further combines the enhancements of the print release portion of the present invention, the cleaning portion of the present invention, and the drying portion of the present invention. The combination of at least two of the contributors directs a method and apparatus forward for utilizing screen printing technology for applying solder bumps to IC Die or wafers, resulting in a repeatable, low cost solution.

Brief Description of the Drawings

FIG. 1a through 1d describes the prior art, presenting the features for screen printing solder paste, and the like, onto a printed circuit assembly, integrated circuit wafer, and the like.

FIG. 2 teaches the limitations of the prior art, describing an aspect ratio.

FIG. 3 is a flow diagram showing the steps of the print release portion of the present invention.

FIG. 4 is a perspective view of a stencil showing a single aperture above an object and the desirable location for deposition of a material.

FIG. 5 is a cross sectional view that illustrates the forces exerted on the material during the preferred process to separate a stencil and an object.

FIG. 6 is a cross sectional drawing which illustrates two preferred methods of transferring the vibrational forces to the material and stencil to assist in the release process.

FIG. 7 is an isometric view of a test stencil used to validate the present invention.

FIG. 8 is a cross sectional view of a deposition of solder paste onto a receiving pad illustrating the advantages found during experimentation of the present invention.

FIG. 9 is a sectional side view of a stencil cleaner in the drying cycle in conjunction with the use of ultrasonic transducers.

FIG. 10 is a sectional side view of a solder stencil cleaning apparatus using vibrational energy for cleaning and drying.

FIG. 11 is a sectional side view of a solder stencil in conjunction with an under wiping system with the use of an ultrasonic transducer for drying.